

tially used, followed by radiosurgery to treat the residual tumor. Radiosurgery is particularly useful for tumors that have recurred after a surgical procedure and conventional radiation therapy, provided the volume of recurrent disease is small.

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Chemoembolization in the Treatment of Hepatic Malignancy

UNRESECTABLE HEPATIC MALIGNANCY, either primary or metastatic, carries a grave prognosis, with a usual life expectancy of three months to six months, and, unfortunately, the condition is common. Colon carcinoma, which frequently spreads to the liver, will take 60,000 American lives every year. Hepatocellular carcinoma (HCC), the most common fatal malignancy worldwide, is endemic in the Orient. With Pacific Rim migration, the incidence is expected to increase in the western United States. Response rates with systemic chemotherapy are about 30% and, in hepatic metastases caused by colon carcinoma, about 20%.

The poor prognosis and high prevalence have led to innovative treatments of liver tumors, including infusing chemotherapy directly into the hepatic artery (to increase the concentration delivered to the tumor) and blocking the blood supply with microscopic particles (to cause tumor ischemia). Chemoembolization is a combination of the two therapies in which chemotherapy and particles are infused simultaneously.

Three congruent circumstances permit the safe and effective application of such regional treatments: the liver has a dual blood supply with either the hepatic artery or portal vein capable of sustaining the organ; tumors of the liver are supplied by the hepatic artery; and the hepatic artery is nearly always accessible percutaneously with current catheterization techniques.

Patients eligible for chemoembolization include those in whom the tumor is unresectable yet confined to the liver. Initially, angiography of the celiac axis and superior mesenteric artery are done to determine the blood supply of the liver and status of the portal vein. A small (2F to 3F) catheter is placed coaxially through the larger (5F to 6F) guiding catheter past the intestinal and gallbladder vessels into the hepatic artery. The chemoembolization mixture is infused while monitored by fluoroscopy. Nausea and pain after the procedure are greatly relieved by the antiemetic ondansetron and intra-arterial lidocaine, respectively. Complications such as embolization of the intestine, hepatic abscess, or infarction occur in less than 3% of patients. Response rates in hepatocellular carcinoma have ranged from 50% to 75%. In addition, most recent studies have involved patients who failed to respond to systemic chemotherapy.

Newer applications and broader use of hepatic chemoembolization are expected. Such advances may include the shrinkage of hepatic malignancies permitting curative resection, palliation until liver transplantation, safe use in patients

with portal vein thrombosis, and the application in children with hepatoblastoma and hepatocellular carcinoma.

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Vasodilator and Exercise Cardiac Perfusion Scintigraphy

THE LONG ANTICIPATED Food and Drug Administration approval of two technetium 99m (^{99m}Tc)-based cardiac perfusion imaging agents and the coronary vasodilator dipyridamole for intravenous administration occurred early in 1991.

Dipyridamole increases coronary blood flow without exercise and improves the sensitivity of isotope imaging in those patients unable to exercise well. Side effects such as chest pain, headache, and dizziness are common but reversible with aminophylline.

The two ^{99m}Tc isonitride agents differ greatly in biodistribution. The ^{99m}Tc -teboroxeme redistributes rapidly from myocardium. This has advantages for rapid sequential stress and rest imaging but demands rapid imaging following exercise. Ideally, the exercise is done in close proximity to a multi-head single photon emission computed tomography (SPECT) system.

The ^{99m}Tc -sestamibi agent remains fixed for hours in the myocardium proportional to regional blood flow at the time of injection. This has distinct logistic advantages. The physical distance of the laboratory from the nuclear medicine site or delays in completing examinations no longer compromise the study as they might with thallium 201 (^{201}Tl). The ^{99m}Tc not only reflects perfusion but also shows myocardial viability better than ^{201}Tl . Areas of ischemia appearing as infarcts are less common.

Both ^{99m}Tc compounds have distinct physical advantages over ^{201}Tl . The 140 kiloelectron volt (keV) photons are less attenuated by tissue and better suited for SPECT imaging than ^{201}Tl (80 keV). The shorter half-life—6 hours versus 73 hours—allows more activity with less radiation absorbed. Initial reports indicate comparable or favorable results compared with ^{201}Tl , and further experience is likely to show improved results as the physical advantages are exploited by changing techniques. Cost is comparable and may even be less per study in high-volume departments.

Positron studies have distinct physical advantages over all SPECT agents. With very high-energy (511 keV), short-lived isotopes, attenuation by tissue is minimal and specificity is higher than SPECT. Combined perfusion and glucose metabolism are the gold standard for noninvasive assessment of viability. The high cost and limited availability are major disadvantages.

As the physical advantages of the ^{99m}Tc compounds are exploited to improve the specificity of SPECT imaging, they will have an important effect on the evaluation of coronary

disease by scintigraphy. Vasodilator infusion has already improved scintigraphy results in those unable to exercise well.

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The Simplicity and Safety of Radiologically Placed Gastric Tubes

ENDOSCOPISTS AND, MORE RECENTLY, radiologists have shown that successful gastric intubation, once strictly a surgical procedure, can be done outside the operating room without an incision.

The procedure is done with a fluoroscope while the patient is fully awake. The stomach is inflated with air via a nasogastric tube, which pushes the transverse colon away from the abdominal wall. An appropriate site on the skin surface is prepared and then anesthetized with local anesthesia. For patients in whom a nasogastric tube cannot be passed, the stomach can be inflated through a skinny needle placed percutaneously into the stomach bubble. Under fluoroscopic guidance, a needle is inserted into the gastric lumen through which a guide wire is placed. The needle is removed and the tract is dilated to the desired width (usually 12 F to 16 F). A feeding tube, which usually has some form of anchor, such as a self-retaining pigtail loop, is then inserted. Some prefer to secure the stomach to the abdominal wall using

small T-anchors introduced through separate needle punctures, but we have found that unnecessary.

An advantage of radiologic guidance is that ultrasound can be used to locate the spleen or liver should they be near the proposed entry site, and the colon can be quickly filled with air or contrast material if it is difficult to see with the fluoroscope. If or when a jejunal tube is needed, then the G-tube is readily replaced with a longer tube that is fluoroscopically guided into the small bowel. After bowel sounds return, usually within 24 hours, the tube is then ready to be used for feedings. The procedure usually takes under 30 minutes to do, and, if the tube should stop working after the tract matures—usually by two to four weeks—it is easily exchanged in a few minutes over a guide wire on an outpatient basis.

Because of the distended stomach, air can escape into the peritoneal cavity, which is rarely, if ever, of any clinical consequence. Morbidity and mortality data show that fluoroscopically directed feeding tubes can be placed with the same, and perhaps fewer, complications than surgically or endoscopically placed tubes. That, with the added benefits of no anesthesia or operating room charges, makes the radiologically placed feeding tube an attractive alternative for patients in need of enteral nutrition.

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